September 23, 2002

MEMORANDUM FOR: Clifton S. Middleton
Project Director, Survey Section B

FROM: Charles W. Challstrom
Director, National Geodetic Survey

SUBJECT: INSTRUCTIONS: KANSAS FBN, 2002, & NEODESHA(2) CORS (GPS-1726)
Task Number: 8K6D2000 (FBN)
8K6D4000 (CORS)

GENERAL:

The National Geodetic Survey (NGS), in accordance with the NGS Strategic Plan, is engaging in a campaign of observing stations of the Federal Base Network (FBN) and Cooperative Base Network (CBN) to complete the ellipsoidal and orthometric height components of the FBN and CBN. This survey will observe the 35 FBN stations and possibly a small number of CBN stations in Kansas and tie to the FBNs in the surrounding states. These instructions are a supplement to the STANDING INSTRUCTIONS for this project.

FBN stations LYON and E 272 were found unsuitable for GPS occupation and have been replaced by stations EMP A (PID AH5750) and Y 271 (PID JH0324), respectively. Station VALENCIA has been reset.

Also, three bench marks were added to the project to serve as bench mark ties. They are: SKIRT RM 2 (PID KE0998), D 154 (PID KH0214), and Q 112 (PID KF0306).

In addition, 13 network stations will be observed to check ellipsoid heights versus leveling. They are the following: SMILEY, TENNIS, M 358, Y 34, 3JC B (also a FBN), Z 191, U 216, J 191, Q 99, D 287 (also a bench mark tie), G 106, M 55, and X 42.

Also being observed are the reference marks at the Neodesha(2) CORS site.

N/NGS21:DHendrickson:713-3194:amg:9-19-02
A:\KNFBN

Various entities in the state may also co-observe and will have their observations coordinated by Monroe Rivers, NGS State Advisor.

Lastly, due to the existence of many National CORS in the region, Central Temporary CORS (CTCORS)throughout the project are not needed. However, receivers can still be deployed at relatively secure stations within the vicinity of the ongoing observing sessions, if desired. If so, the receivers should continuously collect data at a 30-second epoch collection interval for a minimum of 72 hours and for as long as observations are ongoing in the vicinity.

The project will be performed under the technical management of NGS.

SPECIFICATIONS:

Project requirements for the FBN and CBN observations are to ensure 2-centimeter local accuracy in the horizontal component, as well as 2-centimeter local accuracy for the ellipsoid heights.

Data from the CORS in the region are to be used in the processing. There are 13 National CORS in the area to be selected from. Four are in Kansas; three are in Oklahoma; two each are in Nebraska and Missouri; and one each are in Colorado and Iowa. There are also three base stations in Kansas to be used. They are SALINA BASE (PID AE1678, EPA BASE (PID AA2874), and BOEING AIRCRAFT BASE (PID AE5419).

The four National CORS in Kansas are: Neodesha (NDS1), Haviland (HVLK), Hillsboro (HBRK), and Kansas City 1 (KAN1). The three National CORS in Oklahoma are: Lamont (LMNO), Haskell (HKLO), and Vici (VCIO). In Nebraska, the CORS are Fairbury (FBYN) and McCOOK (RWDN). In Missouri, the CORS are Conway (CNWM) and Lathrop (LTHM). Lastly, the National CORS in Colorado and Iowa, respectively, are Granada (GDAC) and Omaha 1 (OMH1).

Positions for and data from the National CORS are available from the NGS web site. Contacts for the three base stations are given in the descriptions.

General specifications for the project are as follows. At each FBN and CBN site, three sessions of 5 1/2 hours duration each shall be observed. The observing scheme shall be arranged so that for each station, the start time of one of the observing sessions shall be at least 4 hours different from the other two. For out-of-state ties, only one 5½ hour session is needed.

The observing scheme shall be arranged to ensure that adjacent FBN and adjacent CBN stations are directly connected in at least one observing session, and at least half of all base lines are repeated.

The CORS base lines will be repeated. CORS and CTCORS data will be used throughout the project.

CBNs can be tied to adjacent FBNs (instead of adjacent CBNs) if the FBN is closer than an adjacent CBN. The repeated base line requirement also applies to the CBN, and a base line consisting of a CBN and a FBN (instead of two CBNs) can be used.

Each FBN and CBN, if not a first- or second-order bench mark, must be tied to two different bench marks. This bench mark tie requirement can be satisfied in one or two sessions.

Specific to the Neodesha(2) CORS site is that for the two reference marks, two sessions of 2 hours each shall be observed. In order to provide a check, the equipment shall be broken down and reset with a minimum of 30 minutes between the two sessions. Since the CORS site is to be tied to the nearest FBN/CBN station, the FBN/CBN station must be occupied simultaneously with the two reference marks. If the occupation of the FBN/CBN station is ancillary to the project, observe the two 2-hour sessions there and break down the equipment as described above. If the occupation of the FBN/CBN tie station is part of the specific FBN/CBN sessions, occupy the station for the entire 5 ½-hour session with no equipment breakdown.

For the Neodesha(2) CORS site, the reference marks are NDS1 A (new mark) and NDS1 B (new mark). The FBN/CBN tie station to use is NDSK A (PID AE5432), a FBN. The backup tie station is NDSK B (PID AE5433), a CBN.

In general, station occupation and observing procedures must be carried out according to appropriate sections of the "NGS Operations Handbook" and the current applicable receiver field manuals. Data formats and digital file definitions are given in "Input Formats and Specifications of the National Geodetic Survey Data Base," Volume I. Horizontal Control Data, Federal Geodetic Control Subcommittee, September 1994, revised and reprinted November 1998. Success in meeting the accuracy standards will be based on repeatability of measurements and adjustment residuals.

General specifications for the project are given in "Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques," Version 5.0: dated May 11, 1988, reprinted with corrections August 1, 1989. Specific project criteria and deviations from the general specifications are given in the following sections.

Project Network - A list (Table 1) and sketch of stations involved in this project will be provided.

Data Acquisition - Data collection must be accomplished as specified in the appropriate dual-frequency receiver field manuals in the compressed mode at a 15-second epoch collection interval. The GPS receivers must be dual-frequency and full-wavelength. Track satellites down to a 10-degree elevation angle.

The satellite observing scenario has been determined. Sessions will generally begin at two observing windows at least 4 hours apart - 1300 UTC and 1700 UTC. Vectors between the project stations shall be measured by single sessions consisting of continuously and simultaneously tracking for 5 1/2 hours.

Record weather data just before, immediately after, and at the mid-point of each session. Meteorological data shall also be collected immediately after an obvious weather front passes during a session and immediately before it passes, if possible. Pressure and relative humidity measurements must be made near and at about the height of the GPS antenna phase center. Indicate in the log the location of the barometer and psychrometer.

Survey operations shall be conducted with due regard to the safety of personnel and equipment. Contact with the airport traffic control tower is mandatory during surveys at any controlled airports.

Vector Computations - Refer to Section V. (DATA PROCESSING) of the STANDING INSTRUCTIONS for information concerning how to process the data. Dan Callahan, N/NGS412, will be responsible for the processing and will perform all quality checks for conformance with NGS format standards.

Station Descriptions - Station recovery notes must be submitted in computer-readable form using WDDPROC software. Include the name, address, and, if public ownership, the telephone number of the responsible party. Do not include the telephone numbers of private property owners.

Special Requirements - Antenna set-up is critical to the success of this project. Fixed-height tripods are preferred for all receivers. Fixed-height tripods shall be tested for stability, plumb alignment, and height verification at the start and end of the project. The plumbing bubbles on the antenna pole of the fixed-height tripod must be shaded when plumbing is performed. They must be shaded for 3 minutes before checking and/or re-plumbing. Also, the perpendic-ularity of the poles must be checked at the beginning of the project and any other time there is suspicion of a problem.

When a fixed-height tripod is not used, the height of the antenna must be carefully measured to prevent station set-up blunders from occurring. Tribrachs used for these set-ups must be checked and adjusted when necessary. Totally independent measurements of the antenna height above the mark in both metric and English units must be made before and after each session. Someone other than the observer must check the measurement computations by carefully comparing measurements and then entering his/her initials on the log. Some GPS antennas have detachable ground planes and radomes. In order to help identify what exactly was used at a particular site, it would be useful to have a snapshot of the setup. All observers should take a photograph of the setup, if possible, with a close-up of the antenna as viewed from the side.

In addition, digital photographs of each survey mark are required. See "Requirements for Digital Photographs of Survey Marks & CORS Antennas," Version 5, for specific information.

Also, a rubbing of the stamping of the mark must be made at each visit to a station. If it is impossible to make a rubbing of the mark, a plan sketch of the mark must be substituted, accurately recording all markings.

Also, for each station visited, a visibility obstruction diagram must be prepared and the TO-REACH description carefully checked for errors or omissions.

Lastly, the following must be recorded on the GPS Station Observation Log form (available at http://www.ngs.noaa.gov/PROJECTS/FBN and click on the Forms link) at each occupation of a station:

(1) receiver manufacturer,
(2) antenna manufacturer,
(3) receiver model number (part number),
(4) antenna model number (part number),
(5) the complete serial number of the receiver, and
(6) the complete serial number of the antenna.

Success of this project requires that the highest quality GPS data be collected. Therefore, during each station occupation, the operators shall carefully monitor the operation of the receivers. Any irregularities in the data due to equipment malfunction, DOD adjustment of the satellite orbit, obstructions, etc., must be reported to the Field Operations Branch, N/NGS41, as soon as possible and noted on the observing log. If the quality of observations for an observing session is questionable, notify the Field Operations Branch immediately.

The survey team shall not depart the project area until they have quality reviewed all data, advised N/NGS21, and notified N/NGS41.

GPS DATA:

Visibility tables and plots of the present satellite constellation for September 16, 2002, have been reviewed and two observing windows selected. For operational use, current data must be generated with Trimble mission planning software or from program SATMAP.

A project report and data listed in Annex L of "Input Formats and Specifications of the NGS Data Base" and in the attached addendum for the adjustment portion of the project must be transmitted. Any data considered suspect as to quality in achieving accuracy standards should be sent via FedEx immediately for office review. Backup of transmitted data must be held until notified by the Field Operations Branch, N/NGS41.

The data set collected during the project shall be named "ksro072d.988". All records in connection with this project shall be titled “KANSAS FBN, 2002, & NEODESHA(2) CORS.” The project number (accession number) is GPS-1726.

LIAISON:

Liaison must be maintained with designated offices at the National Geodetic Survey headquarters located at:

1315 East-West Highway
Silver Spring, Maryland 20910-3282

Questions and problems concerning survey field operations should be directed to:

William T. McLemore, Jr.
Chief, Field Operations Branch
Observation and Analysis Division
N/NGS41, SSMC III, Station 8564
Telephone: 301-713-3215, ext. 117
Fax: 301-713-4327
e-Mail: Bill.Mclemore@noaa.gov

Questions and problems concerning adjustment processing should be directed to:

Maralyn L. Vorhauer
Observation and Analysis Division
N/NGS4, SSMC III, Station 8562

Telephone: 301-713-3176, ext. 104
Fax: 301-713-4327
e-Mail: Maralyn.Vorhauer@noaa.gov

Questions and problems concerning vector processing should be directed to:

Juliana Blackwell
Field Operations Branch
Observation and Analysis Division
N/NGS41, SSMC III, Station 8458
Telephone: 301-713-3215, ext. 108
Fax: 301-713-4327
e-Mail: Juliana.Blackwell@noaa.gov

Questions and problems concerning using CORS data in processing should be directed to:

Neil Weston
Geosciences Research Division
N/NGS6, SSMC III, Station 9830
Telephone: 301-713-2847, ext. 202
Fax: 301-713-4475
e-Mail: Neil.D.Weston@noaa.gov

Questions and problems which could affect the technical adequacy of the project should be directed to:

Stephen J. Frakes (Douglas R. Hendrickson)
Project Development Branch
Spatial Reference System Division
N/NGS21, SSMC III, Station 8853
Telephone: 301-713-3194, ext. 111 (ext. 127)
Fax: 301-713-4316
e-Mail: Steve.Frakes@noaa.gov
(Doug.Hendrickson@noaa.gov)

The NGS project coordinator is:

Daniel Callahan
NGS, Field Operations Branch
538 Front Street
Norfolk, Virginia 23510
Telephone: 757-441-6264
e-Mail: Dan.Callahan@noaa.gov

The contact for the project (co-observing) is:

Monroe Rivers
KS DOT, Docking State Office Building
Survey Section, Room B-50
915 Harrison Street
Topeka, Kansas 66612-1568
Telephone: 785-296-6835
e-Mail: Monroe.Rivers@noaa.gov

The contact for the Neodesha(2) CORS site is:

Seth Gutman
NOAA ERL/FSL/DD
325 Broadway R/E/FS3
Boulder, Colorado 80303
Telephone: 303-497-7031 or 303-497-6200
e-Mail: gutman@fsl.noaa.gov

The secondary contacts for the Neodesha(2) CORS site at the same address are:

Kirk Holub or Mike Foy
Telephone: 303-497-6642 or 303-497-6832
e-Mail: holub@fsl.noaa.gov or foy@fsl.noaa.gov

Names and telephone numbers of local contacts are given in the station description material.

ADDRESS:

Keep N/NGS41 informed of the party's post office, physical address, and telephone number at all times.

PUBLICITY:

See "NGS Operations Handbook," Section 1.4.1.

EXPENSES:

FBN expenses for this project will be charged to task number 8K6D2000. CORS expenses are to be charged to task number 8K6D4000.

TRAVEL:

Travel and per diem are authorized in accordance with Federal Travel Regulations, Part 301-11, Per Diem Allowances. Current per diem rates were effective October 1, 2001.

ACKNOWLEDGMENT:

Please acknowledge receipt of these instructions in your Monthly Report.

cc: N/NGS - D. Zilkoski*
N/NGS - S. Misenheimer*
N/NGS1 - G. Mitchell
N/NGS1x1 - M. Rivers
N/NGS11 - S. Cofer
N/NGS21 - S. Frakes
N/NGS21 - R. Anderson
N/NGS21 - D. Hendrickson*
N/NGS22 - T. Soler
N/NGS3 - J. Bailey
N/NGS4 - E. Wade
N/NGS4 - M. Vorhauer
N/NGS4 - D. Hoar
N/NGS41 - W. McLemore
N/NGS41 - J. Blackwell
N/NGS412 - D. Callahan
N/NGS5 - R. Snay
N/NGS6 - N. Weston
FGCS Members*
Bill Haverkamp, Kansas Department of Transportation
Ken Dedrick, Wilson & Company
Lyle Howell, Leavenworth County
Seth Gutman, National Oceanic and Atmospheric Administration
Kirk Holub, National Oceanic and Atmospheric Administration
Mike Foy, National Oceanic and Atmospheric Administration

* first page only

DATA TO BE SENT TO HEADQUARTERS RELATING TO THE ADJUSTMENT PORTION OF FBN/CBN PROJECTS

Free adjustment in NAD 83 (UNIX run).

Plots of the free adjustment created by running “plotres_prompt.bsh” on a UNIX server. Plots require a printer that supports postscript. The output file (long.out) contains a list of residuals which may be sorted using the following commands:

```
vi long.out
:1,$ !sort +0.47 (sorts horizontal residuals)
:1,$ !sort +0.71 (sorts vertical residuals)
```

(OPTIONAL) Constrained horizontal adjustment holding NGS CORS positions and ellipsoid heights.

Final combined Blue Book file (ASCII required) with *86* records (GEOID99).

Final description file (ASCII required.)

Final G-file (ASCII required.)

OBSCHK output.* **

CHKDDESC output.*

OBSDES output.*

* Any errors or warning messages must be explained.
** Errors relating to incomplete *86* records are acceptable.